Introduction to Space

Business of Space **Space Operations Scho**
5 Dec 2001

The SOPSC

Space Operations School Develops and Teaches Space ONOPs and Tactics, Techniques, and Procedures (TTPs) To Help Space Warriors Fill the Doctrinal Gap

www.schriever.af.mil/swc/sopscweb

Why Bother with Space?

Advantages of Space

Advantages to Space Flight:

- No Drag
- Overflight Permission
- Persistence (Years)
- Pre-Deployed
- Hard to attack

Disadvantages of Space

Disadvantages to Space Flig

- Predictable Orbits
  - -- Easily Countered
- Expensive Lift
- No “on-orbit” servicing

How does the Military make use of Space?

Space Basics and the 4 Mission Areas *Overview*

- **Space 101 - Orbits and their uses**
- ***Space Support* - Lift, Command & Control**
- ***Force Enhancement* - Nav, Comm, Wx, ISR, TMD**
- ***Force Application* - ICBMs**
- ***Space Control* - Surveillance, Identification**
- **Future Space Operations – SOV, SMV, SBR, CAV, SBL**

Overview

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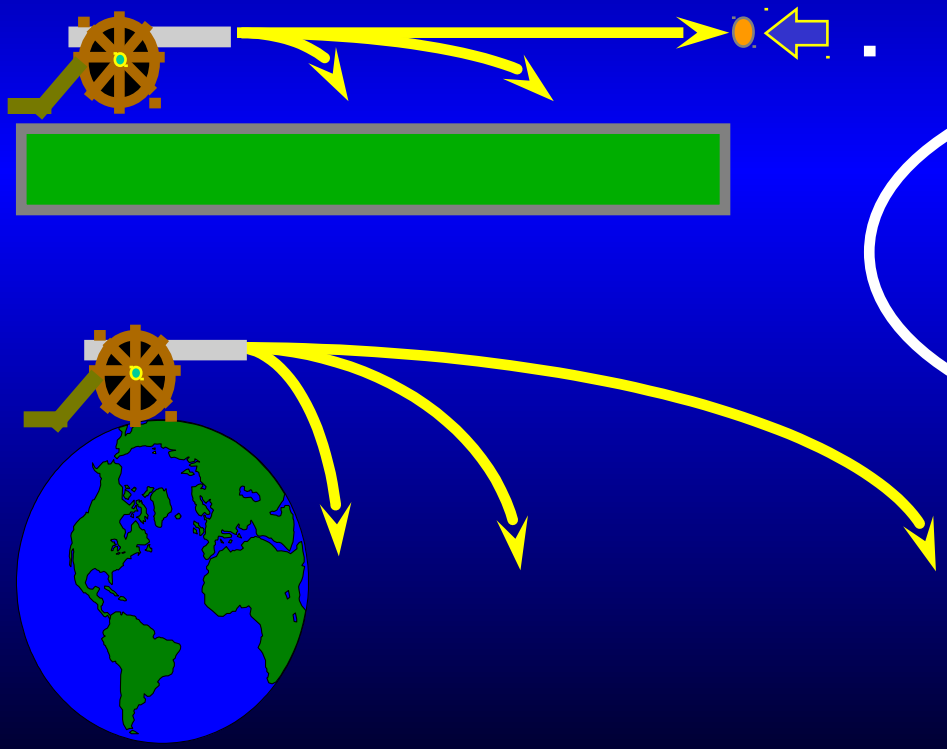
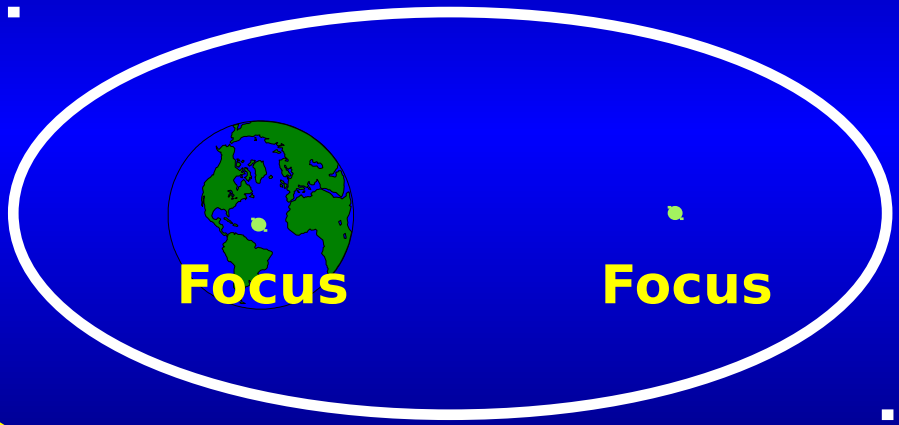
Orbits and their uses

What is an Orbit?





Orbits and their uses

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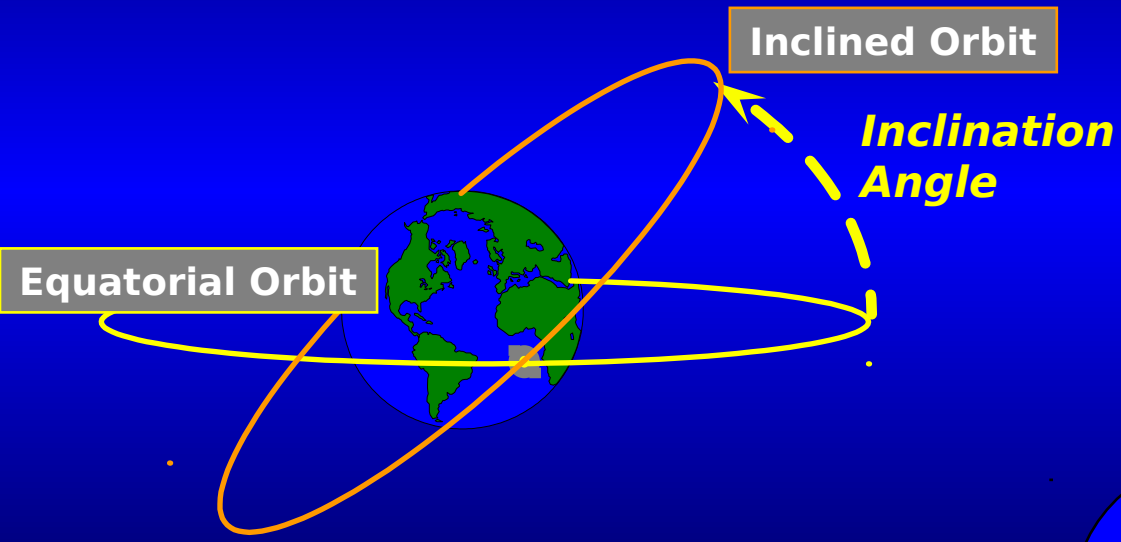
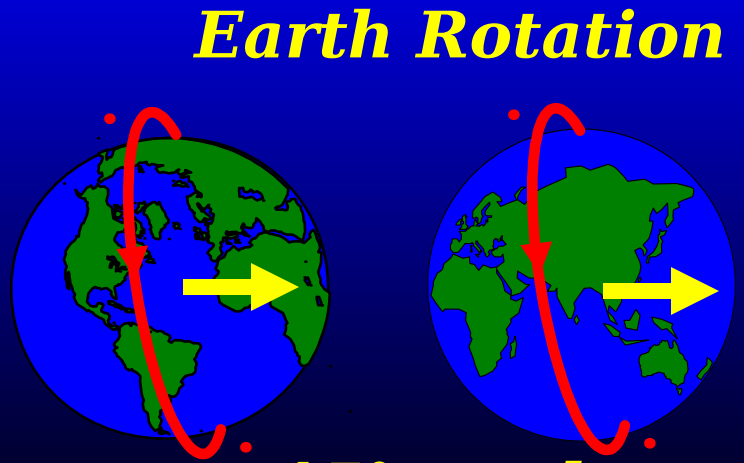
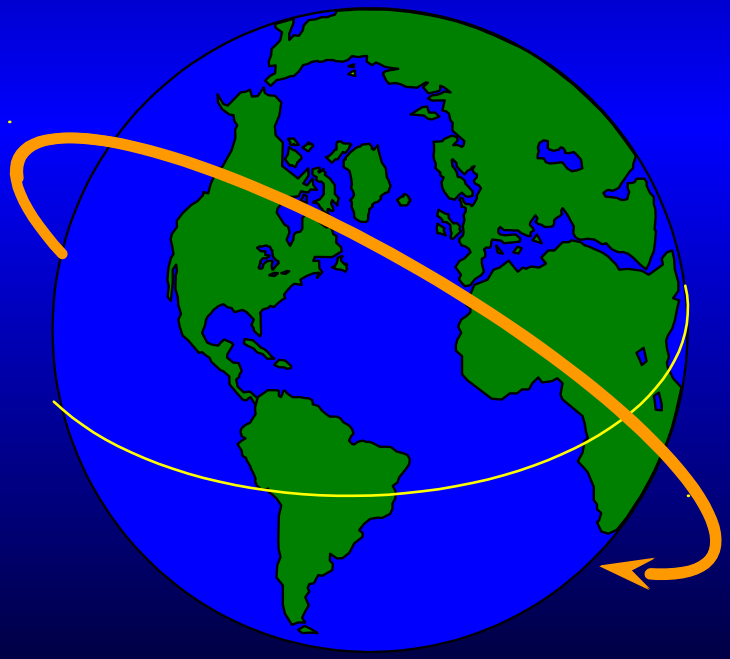
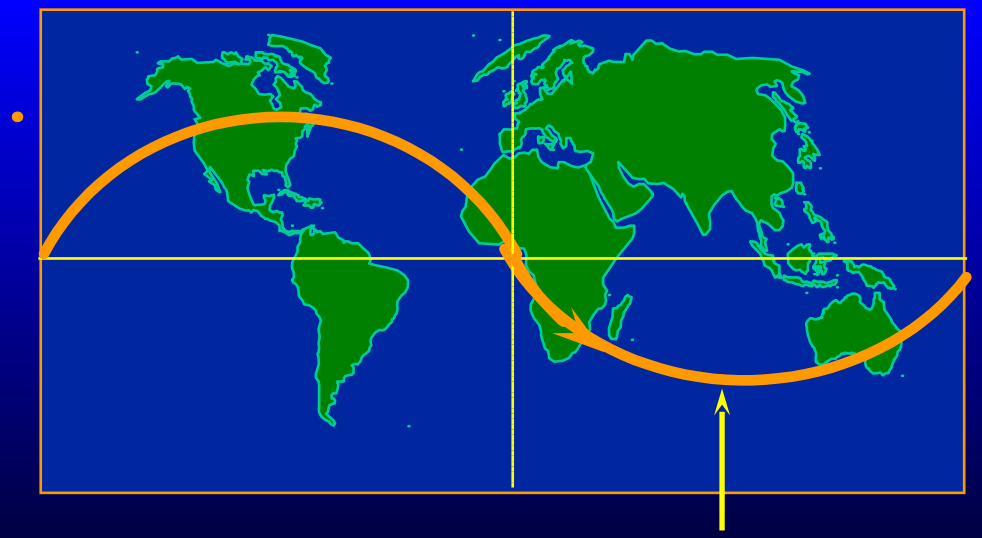




Orbits and their uses

A ground trace is the projection of a satellite's orbit onto the earth's surface

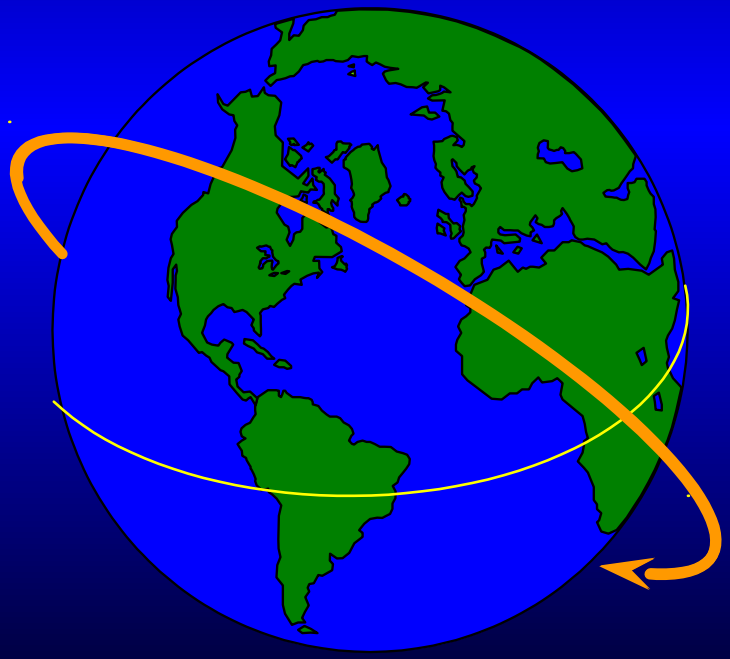


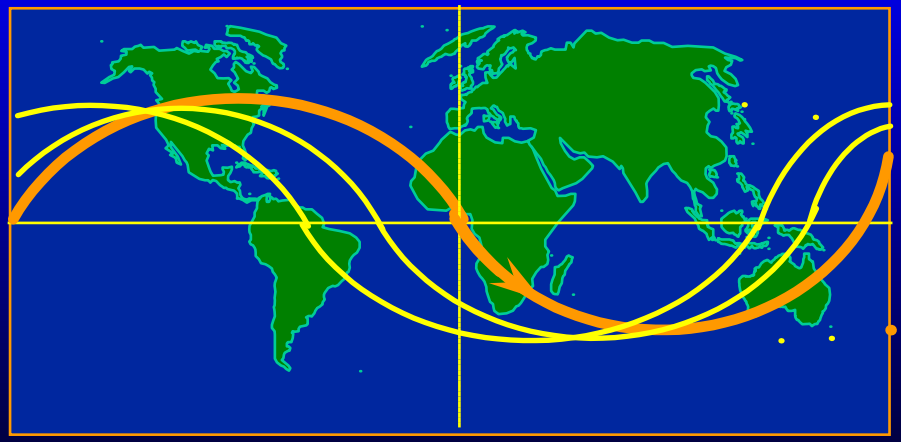


Ground Trace

Orbits and their uses

Certain orbits will have a westward shifting ground trace due to the earth's rotation



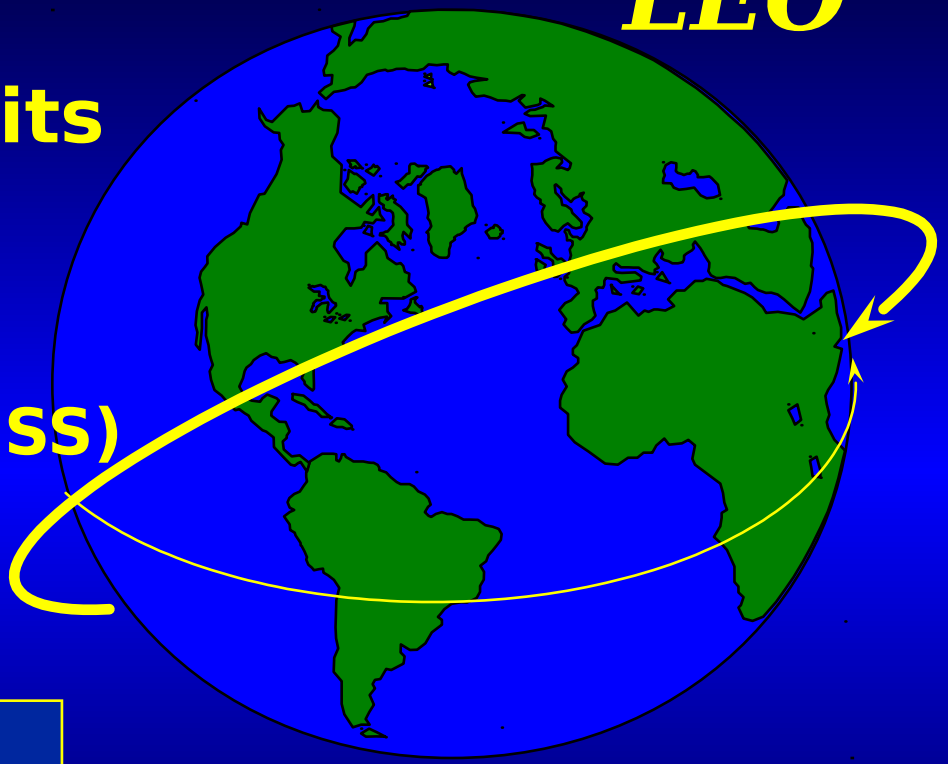


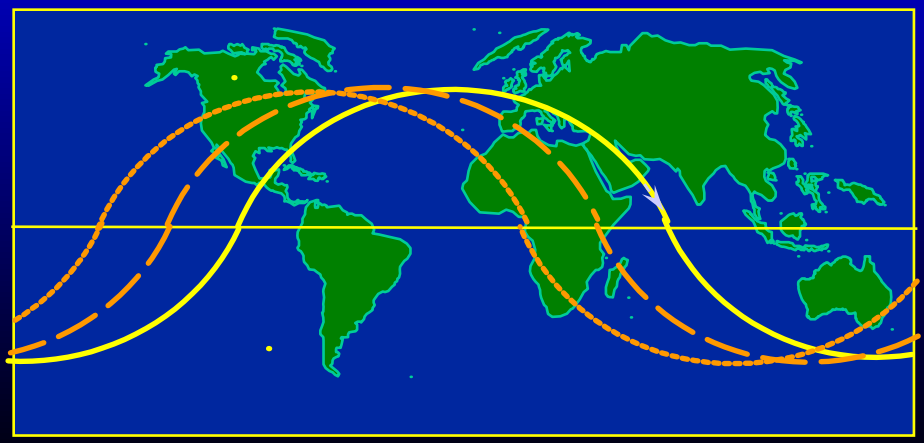
Orbits and their uses

- **Orbit size determines time for one orbit**
- **Orbit size also determines the speed**

Orbits and their uses - LEO

- **Inclined/Polar Orbits**
- **Up to 1000 km**
- **Missions:**
  - **Manned (Shuttle, ISS)**
  - **Reconnaissance**
  - **Communications**



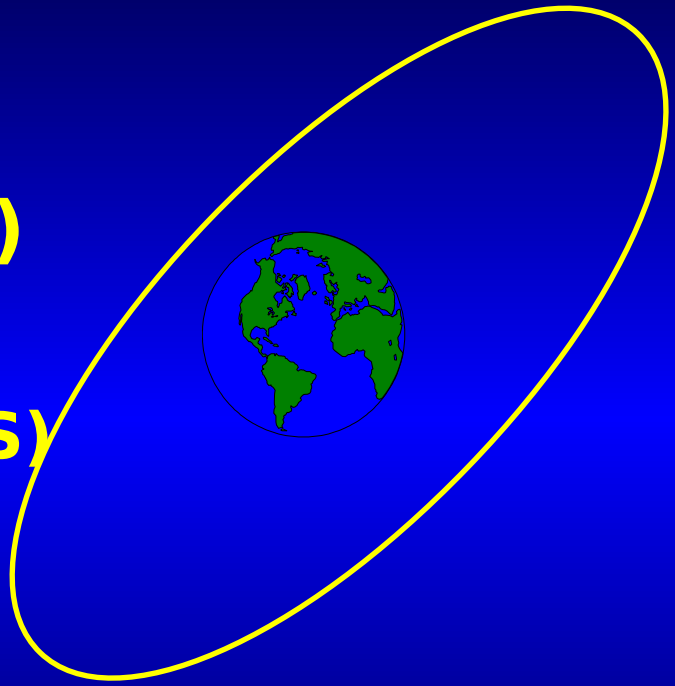


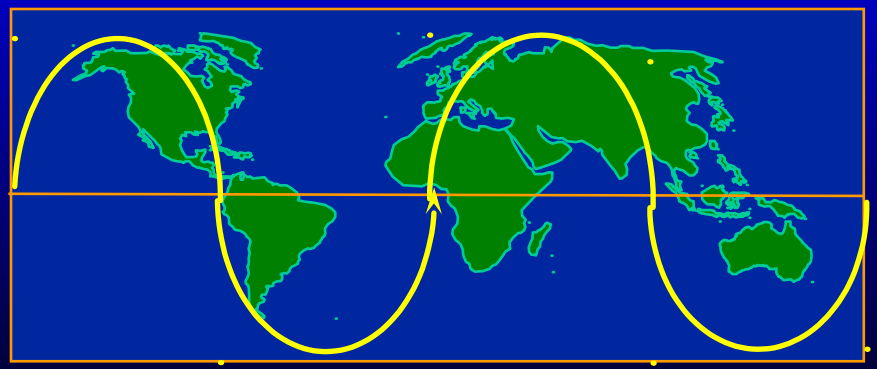
Low earth Orbit (LEO)

LEO

Orbits and their uses - MEO

- **~12 hour period**
- **~20,800 km (11,500nm)**
- **Missions:**
  - **Navigation (GPS/GLONASS)**

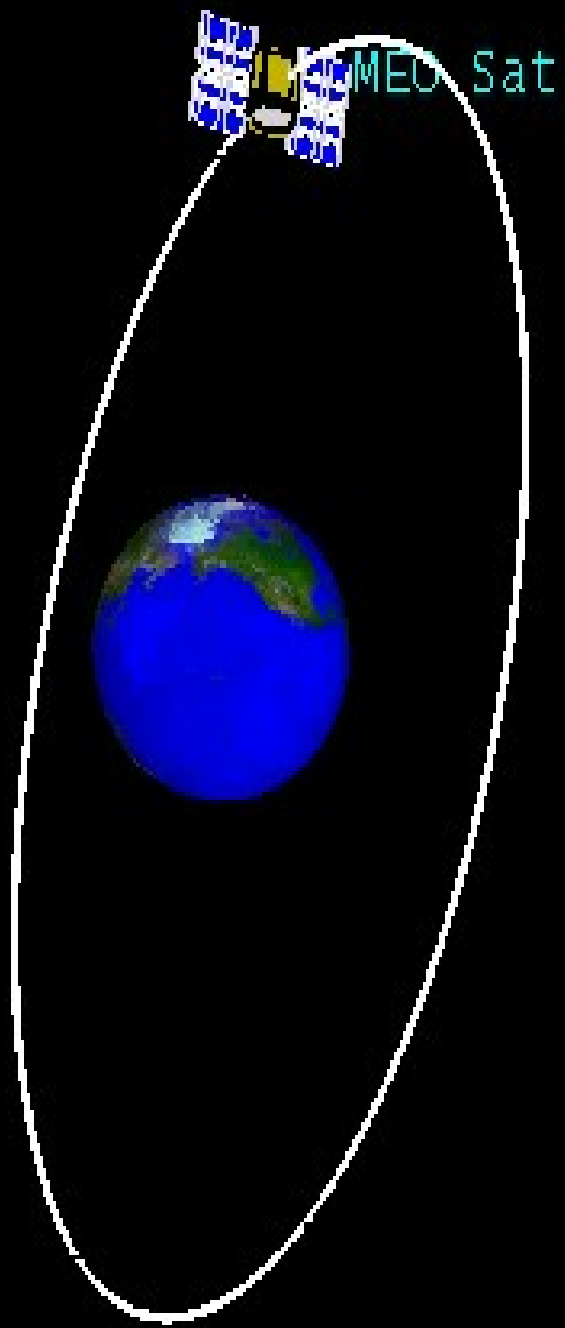


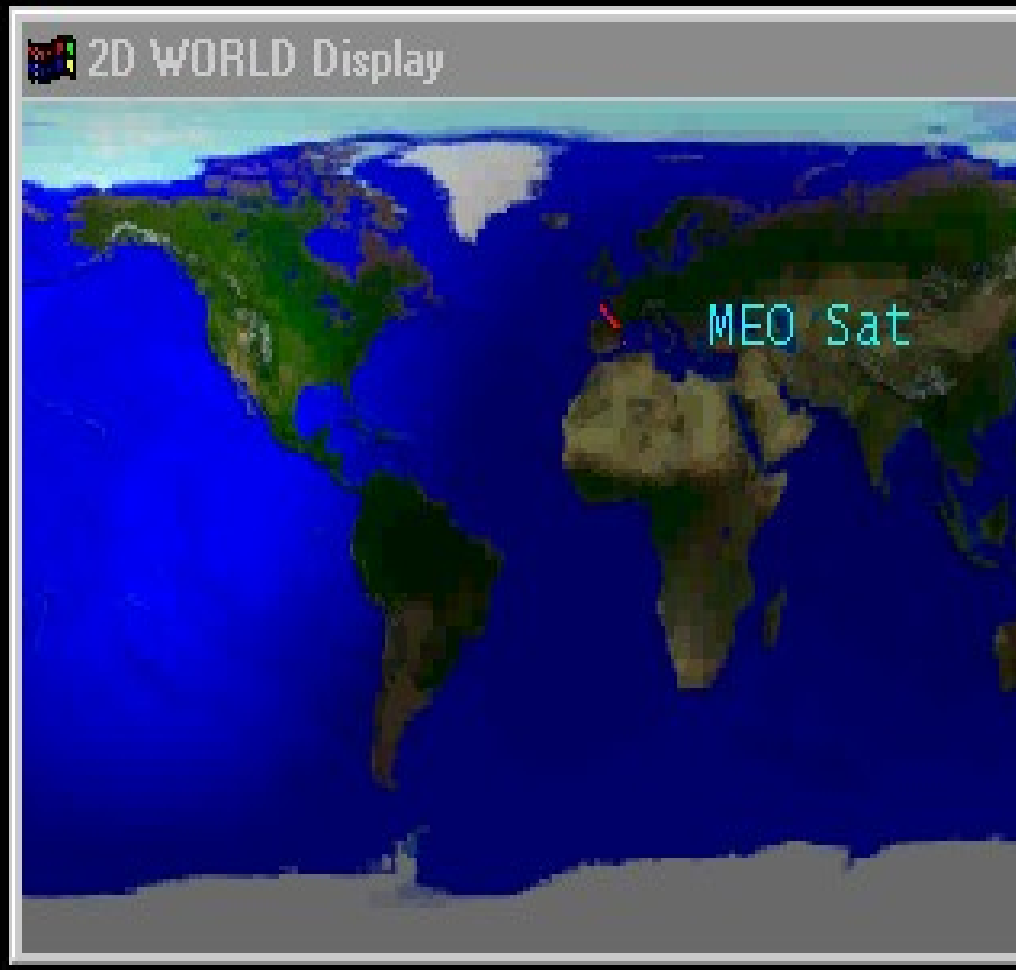


GROUND TRACE

Medium Earth Orbit (MEO)

MEO

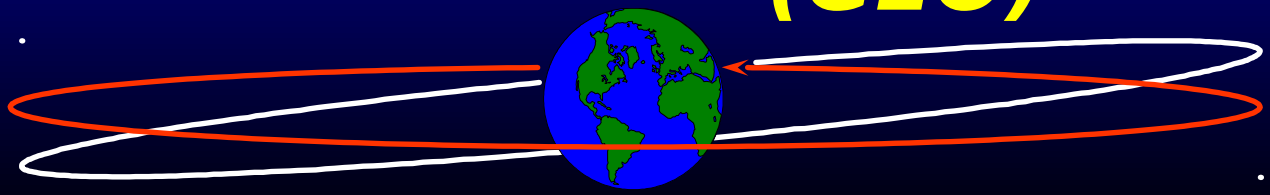


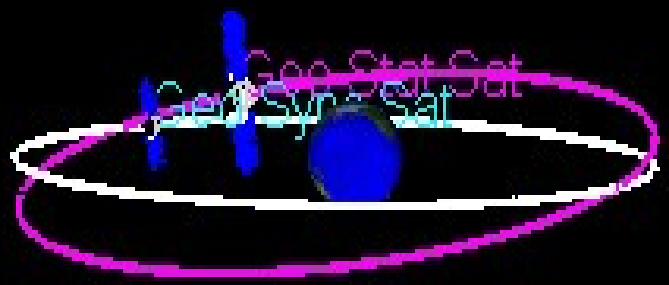


Orbits and their uses

- **24 hour period**
- **Near circular - 37,160 km altitude (23,500nm)**
- **Missions:**
  - **Communications Relay (DSCS/FLTSAT/MILSTAR)**
  - **Surveillance/Warning (DSP)**

Geosynchronous/ Geostationary Earth Orbit (GEO)





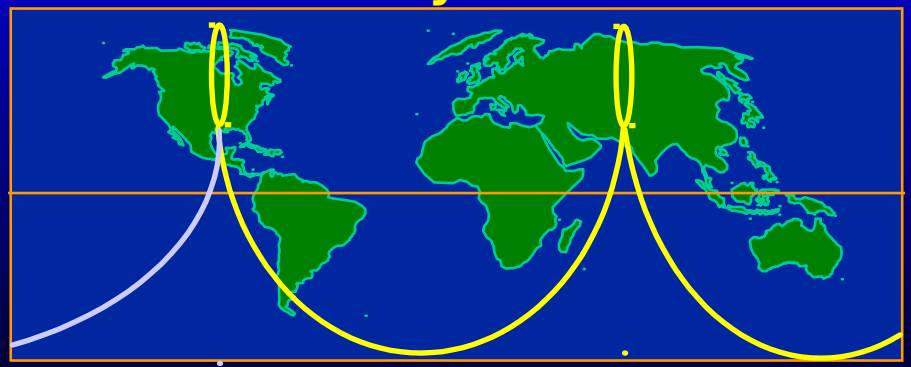
GEO

Geo Stat Sat

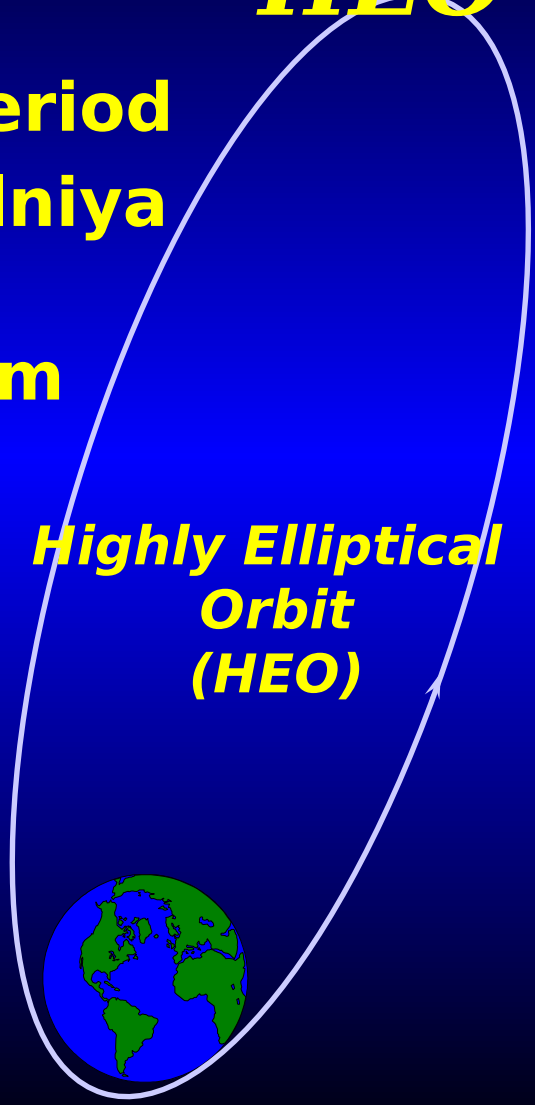
Geo Sync S

Orbits and their uses - HEO

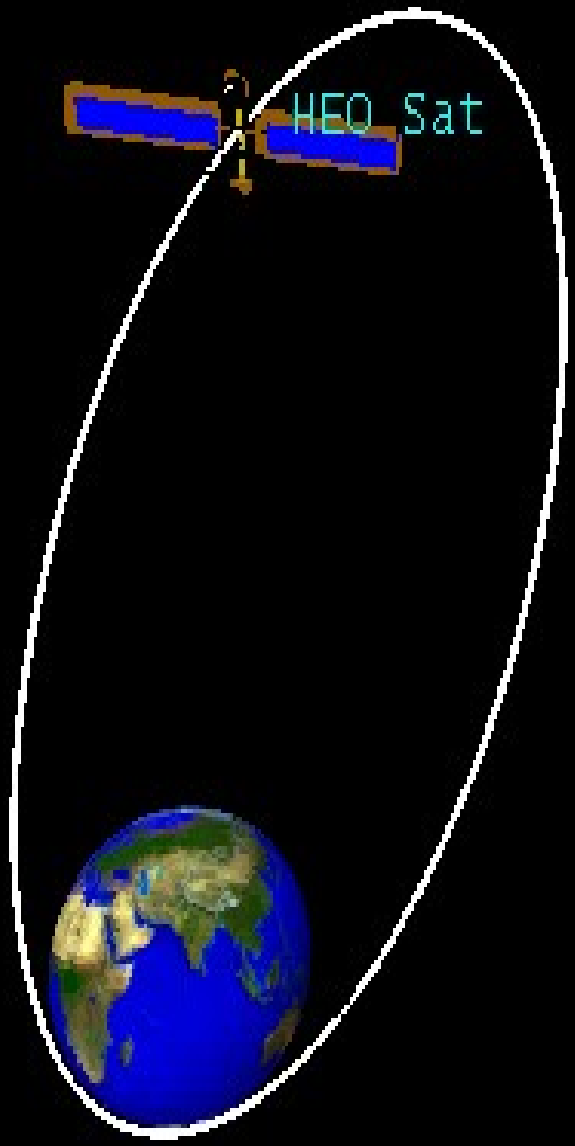
- **Eccentricity ~.7, ~12 hour period**
- **63.4°/116.6° Inclination -- Molniya orbit**
- **~330 km Perigee - ~39,660 km Apogee**
- **Missions:**
  - **Comm Relay**

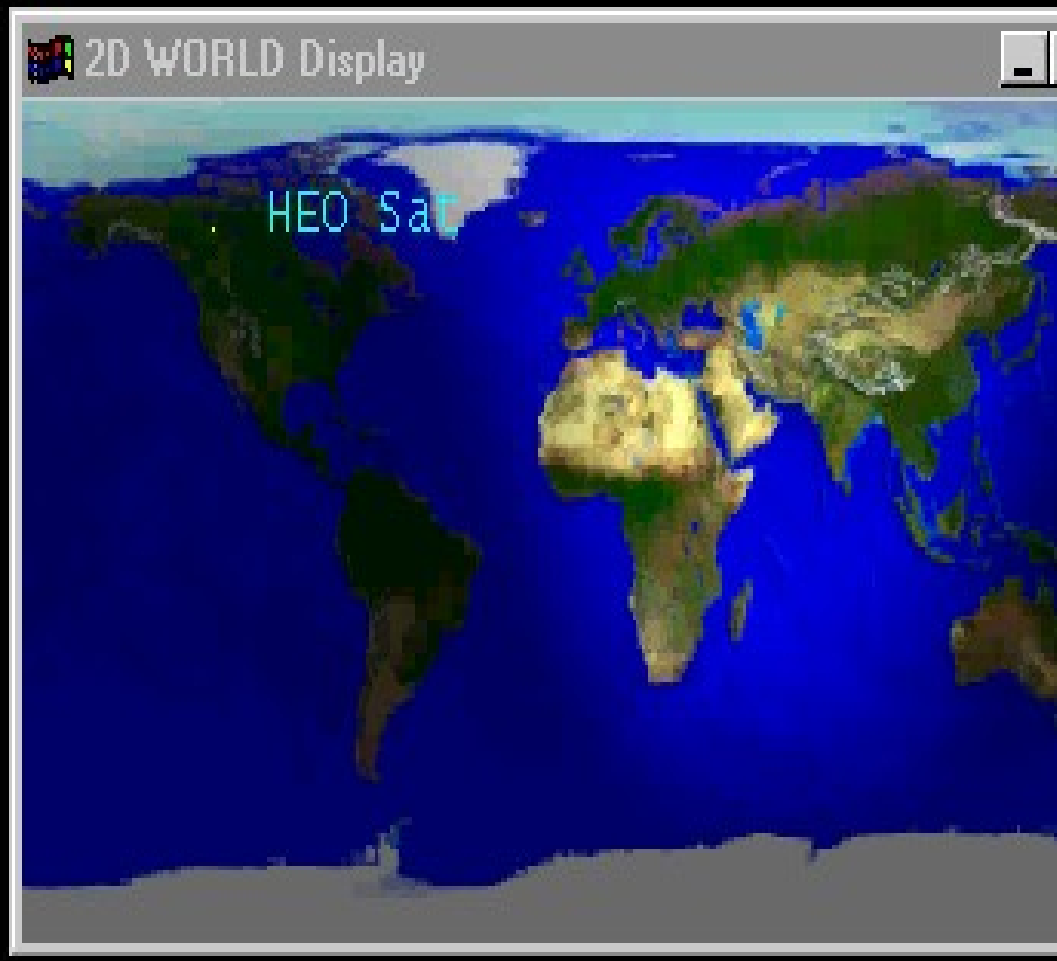


GROUND TRACE



HEO





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Space Support - Lift Vehicles

Delt

Atlas

Titan

Shuttle

Taurus

Pegasus

Athen
a

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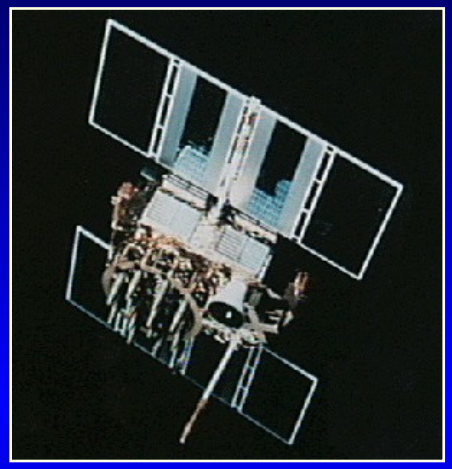
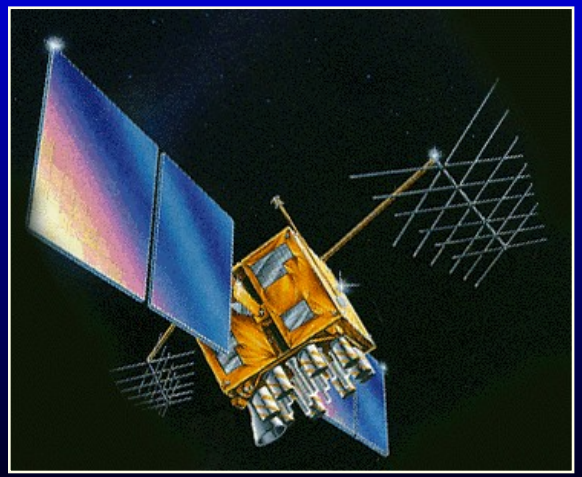
Force Enhancement - Navigation

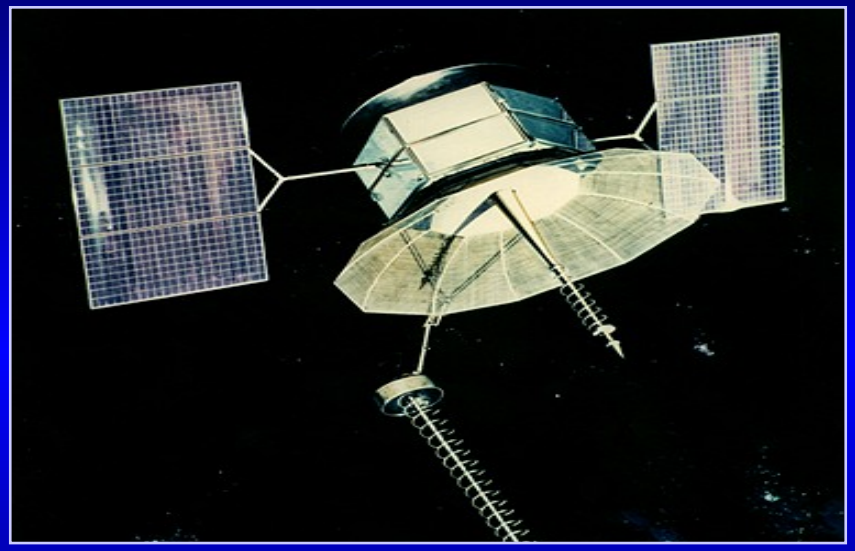


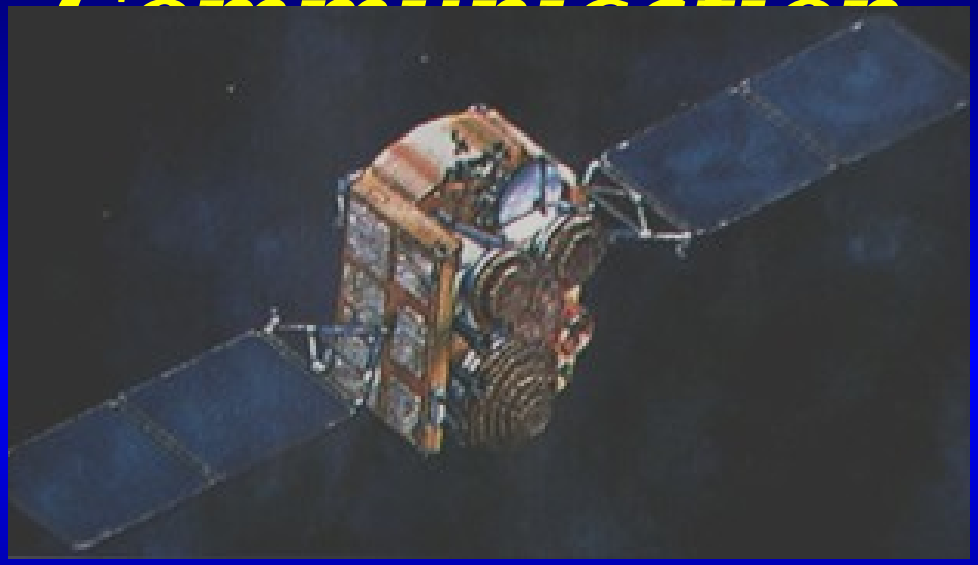
Global Positioning System (GPS)

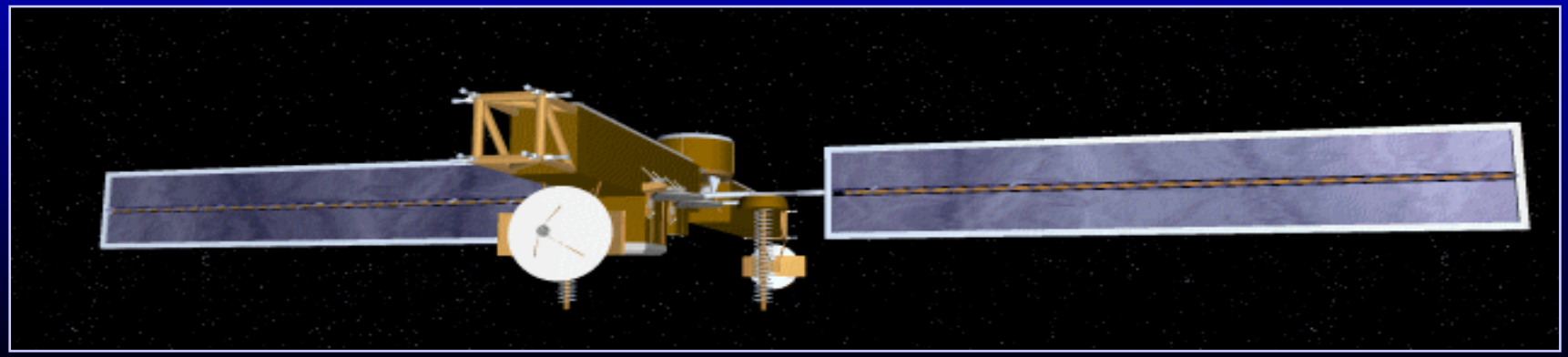
- **Worldwide Precise Navigation**
- **Provide highly precise Position, velocity, and time to users:**
  - **WORLDWIDE**
  - **ANY WEATHER**
  - **24 HOURS/DAY**



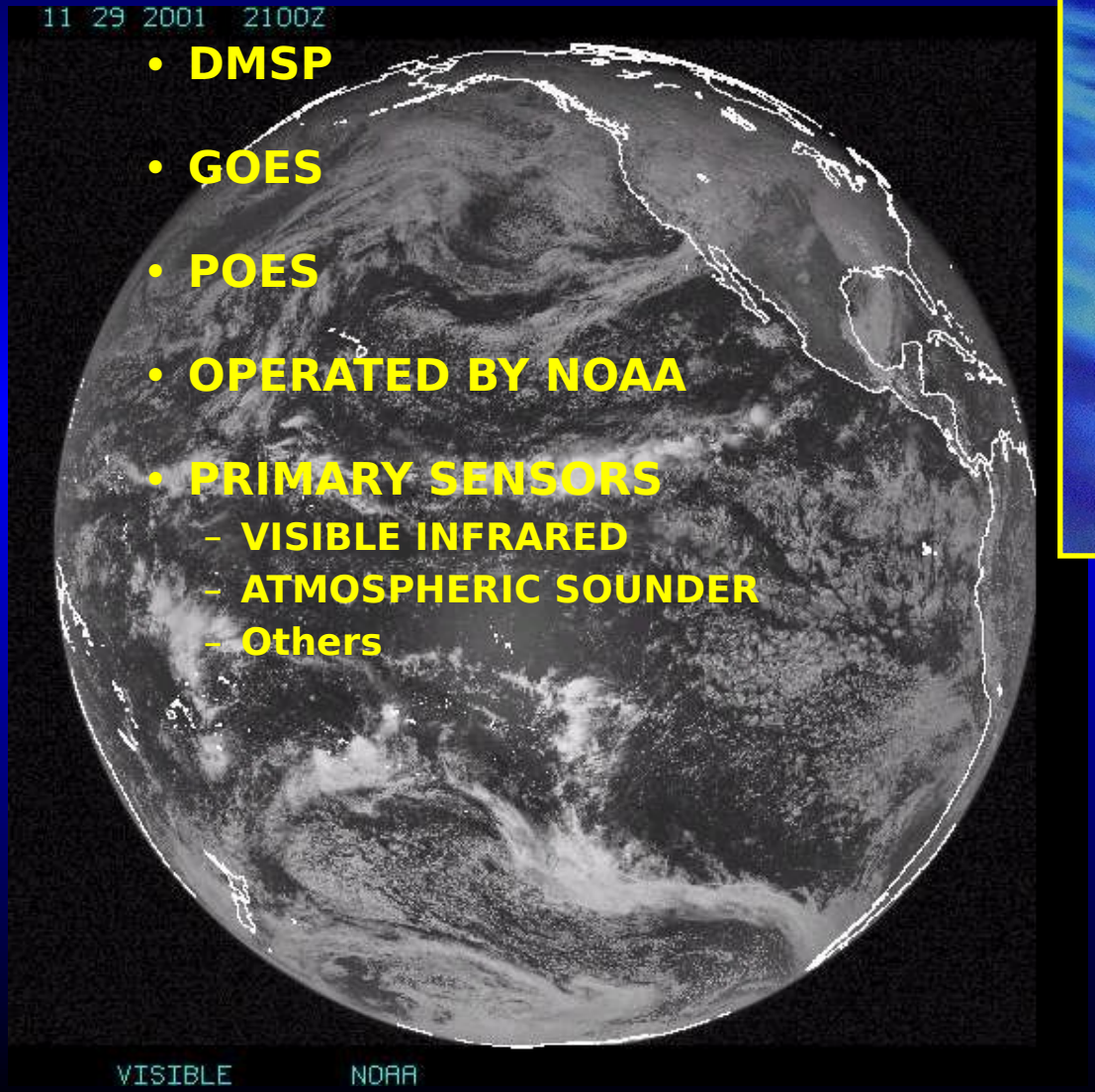
Force Enhancement - Communication



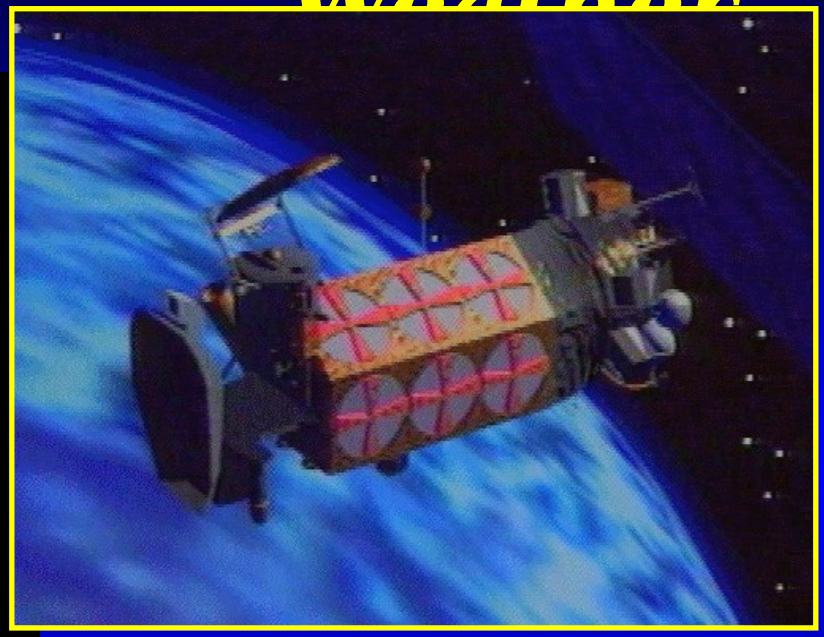




Force Enhancement - Weather



- DMSP
- GOES
- POES
- OPERATED BY NOAA
- PRIMARY SENSORS
  - VISIBLE INFRARED
  - ATMOSPHERIC SOUNDER
  - Others



Force Enhancement - ISR

8 Launchers arranged around a mobile phased array radar

SPOT 10m 25 Nov 97

Probable Patriot Air Defense Battery

Prince Sultan Air Base, Saudi Arab

Force Enhancement - Missile Warning

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U.S. ICBM OPERATIONS

MINUTEMAN III

PEACEKEEPER

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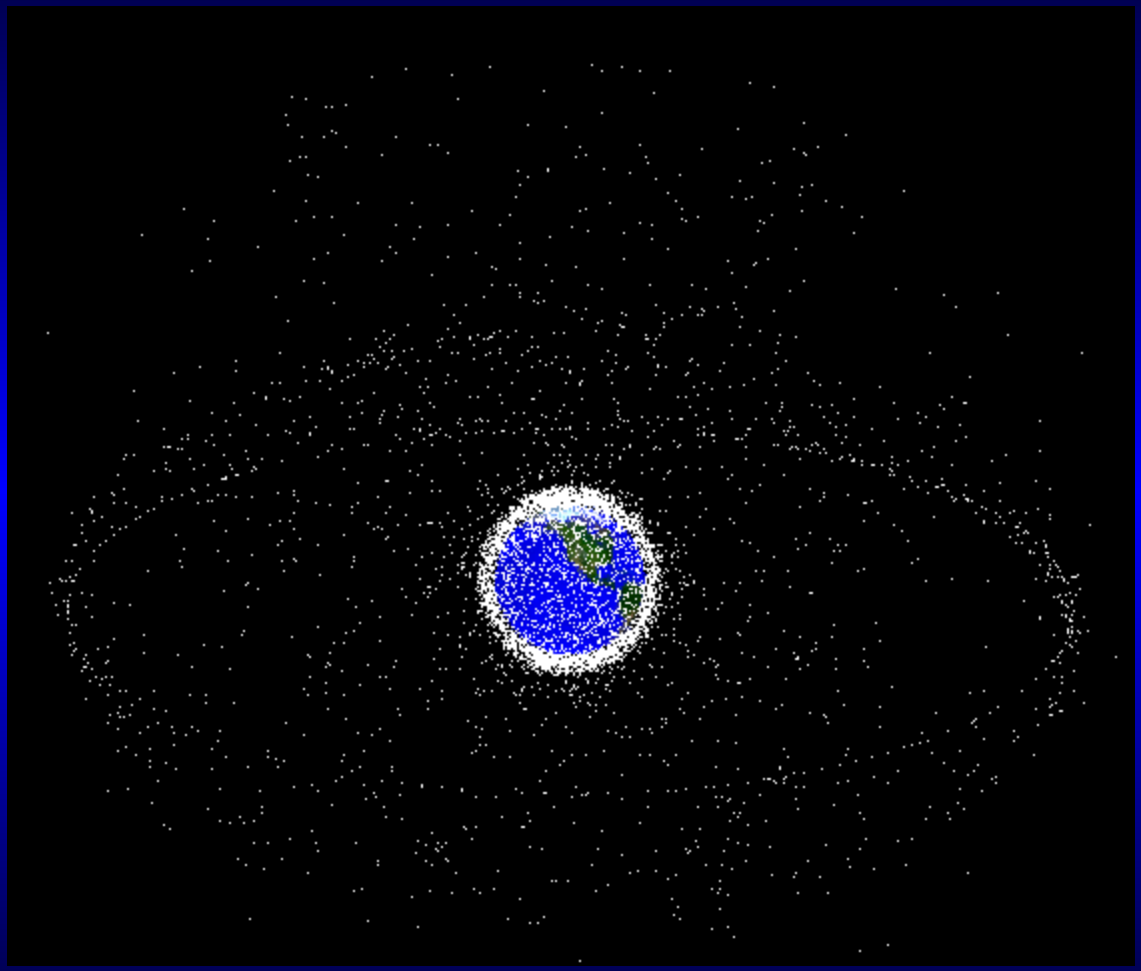
Space Control

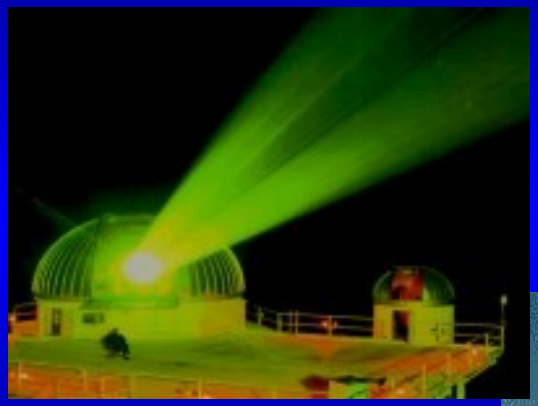
Surveillance and Identification

Space Control



Space Control

Directed Energy Anti-Satellite Weapons (A



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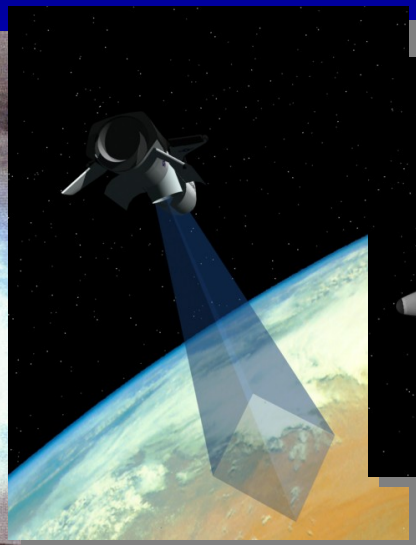
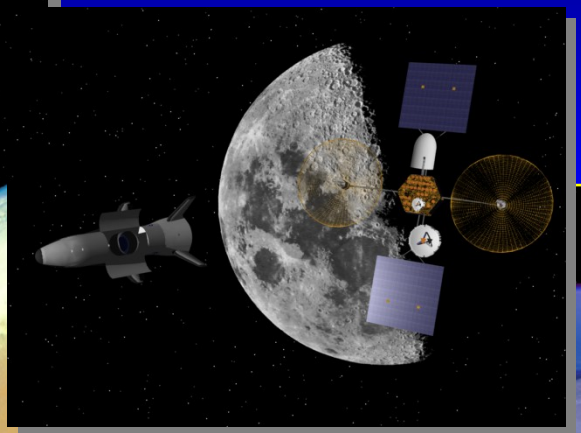
Future Space

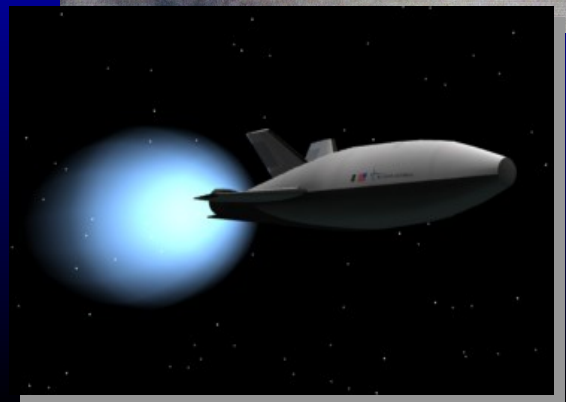
Space Operations Vehicle (SOV)

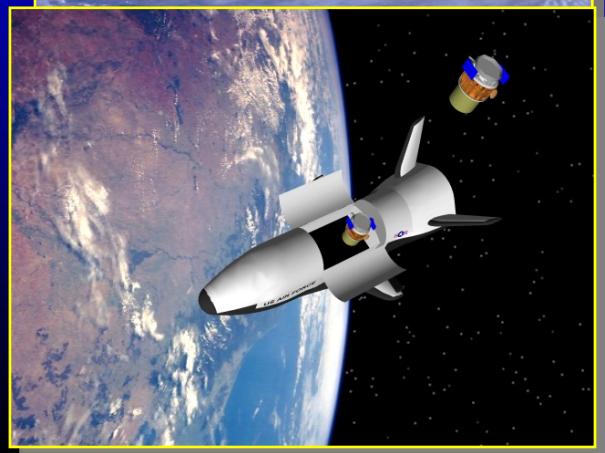
Future Space

Space Maneuver Vehicle (SMV)

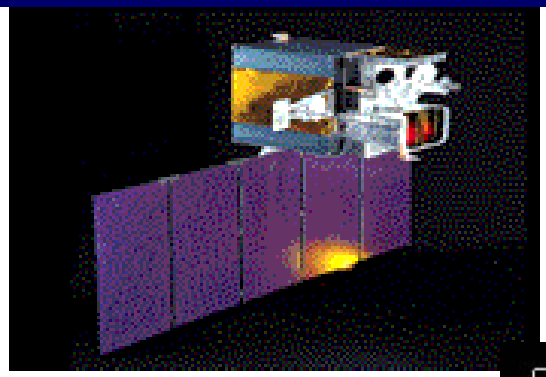






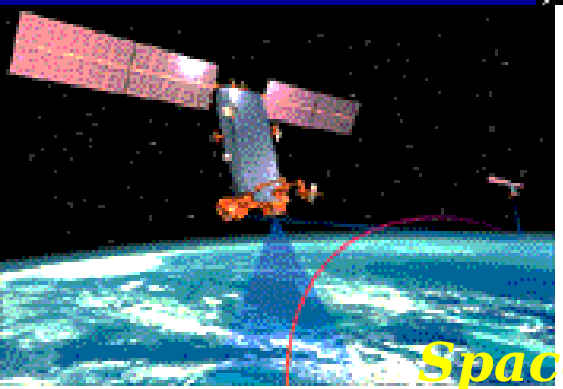


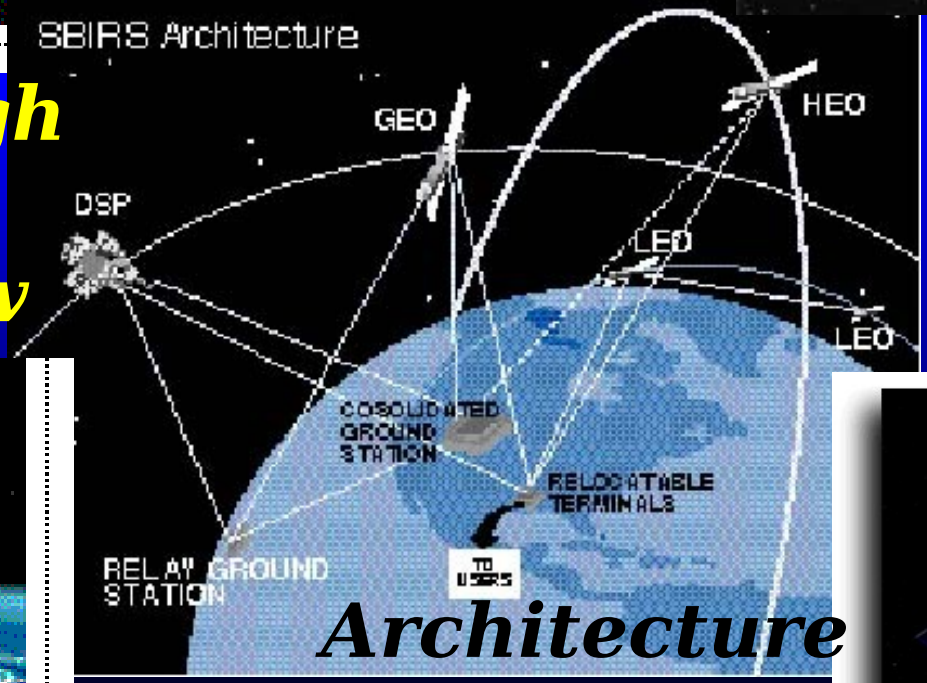
Future Space



SBIRS High

SBIRS Low





Architecture

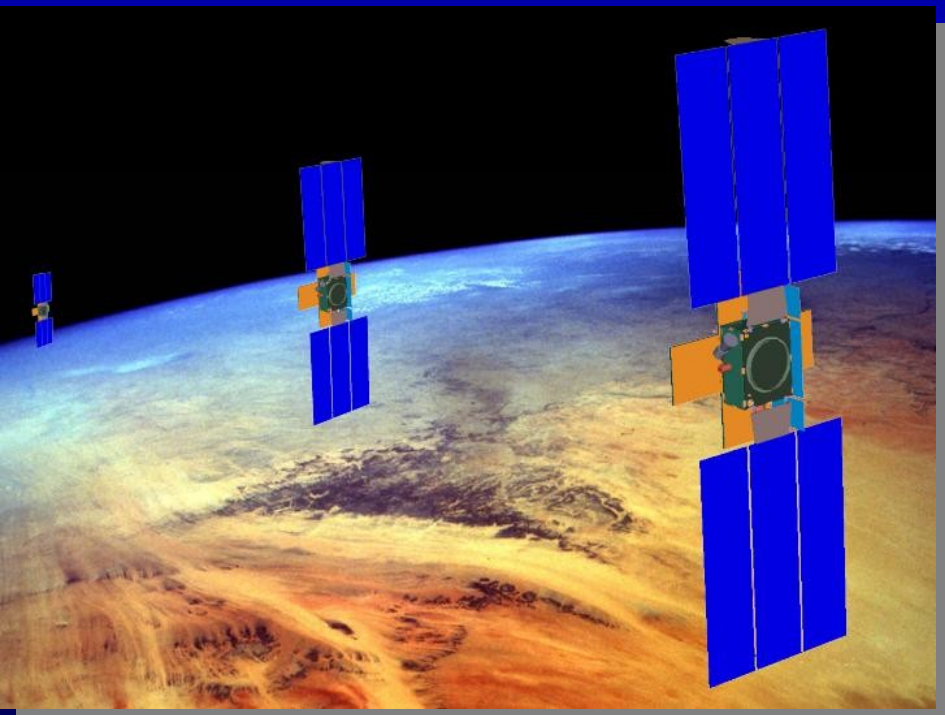
Space-Based Infra-Red System

SBIRS Hig

SBIRS Low

Future Space

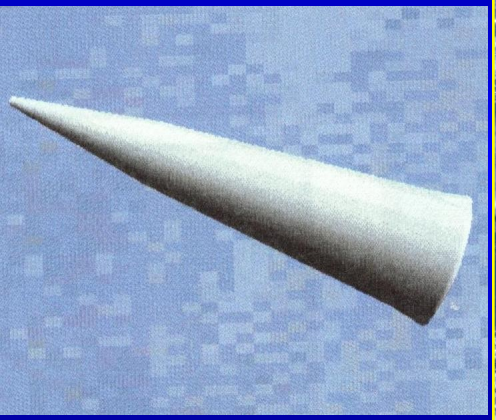
Space Based Radar (SBR)

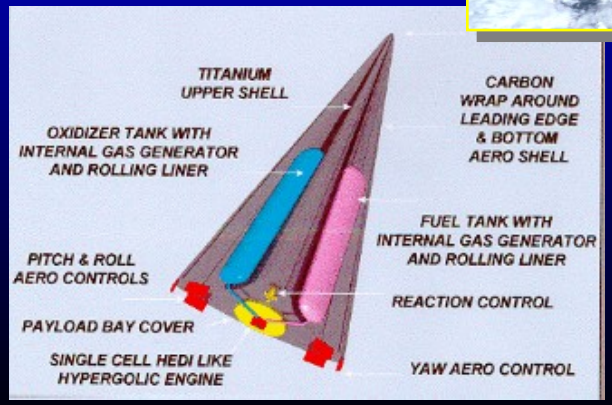


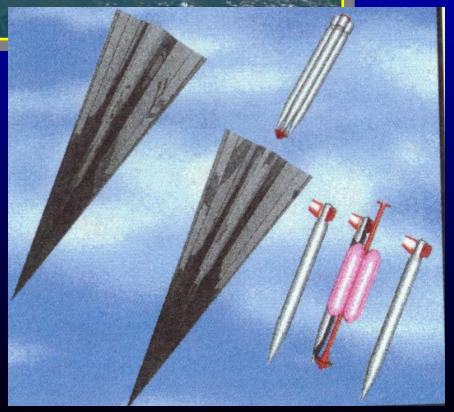
TechSat 21

Future Space

Common Aero Vehicle (CAV)







Future Space

Space Based Laser (SBL)

Introduction to Space

Business of Space **Space Operations Scho**
5 Dec 2001